

Research topics for graduate students for 2025

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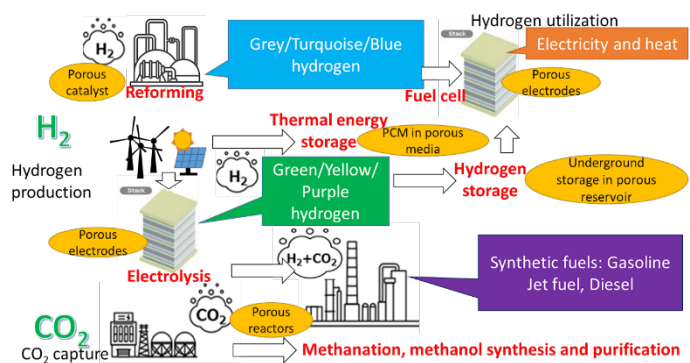
Acceptable course(s)

- Master's Degree
- Doctoral Degree



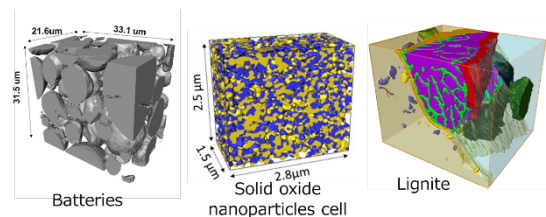
Research Topics

The main topics of research are the production and utilization of hydrogen and synthetic fuels. Technologies like electrolyzers, fuel cells, reformers, chemical reactors, and energy storage systems depends on porous structures. We are working on fabrication, characterization and prediction of highly efficient multiphase micro- and nano-scale porous materials dedicated for energy devices.



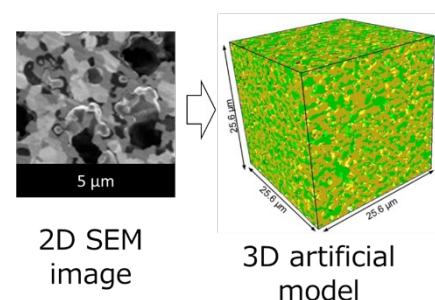
1. Porous structures for energy technologies

To optimize the energy devices is necessary to propose novel fabrication techniques, like nanoparticles engineering and advanced heat transfer designs. At the same time, the comprehensive performance evaluations through measurements and simulations, and detailed 3D material characterization are required [1].



2. Machine learning for predicting porous structures

We use machine learning, like CNNs and GANs, to enhance understanding of energy device microstructures and degradation. Our approach includes predicting complex properties from 2D images and replicating degradation phenomena with physically informed neural networks, addressing challenges of limited experimental data [2].



Articles Related to Research Topics

- [1] A. Sciazko, et al., 3D microstructures of solid oxide fuel cell Ni-YSZ anodes with carbon deposition, Chemical Engineering Journal, 460, 141680, (2023). [DOI:10.1016/j.cej.2023.141680]
- [2] A. Sciazko, et al., Prediction of electrode microstructure evolutions with physically constrained unsupervised image-to-image translation networks, npj Comput. Mater. 10, 49. (2024) [DOI:10.1038/s41524-024-01228-3]

Lab. Web page: <https://sites.google.com/g.ecc.u-tokyo.ac.jp/sciazkolab>